HCI – the domain and the Education –coming of age, expanding territory, and marrying new domains

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ABSTRACT
Having developed academic HCI teaching in many countries, and being involved in professional societies from the start, we will show how the domain of HCI, and the related education, developed in different parts of the world, specifically in North America, Europe, and China. We observed local flavors and differences that in the last decades gradually related, merged, and moved the original domain to broader areas of application and to a larger population of users.

Usability was exchanged for experience, programming languages were replaced by service opportunities, interactive art, and cultural participation.

INTRODUCTION
Based on our own experience, we will discuss the early history of interactive systems and the education on how to design and use them. Having been, both, a researcher in this field and a teacher since the early 60s, our knowledge is based on what we were able to find out and where we had the opportunity to develop education and teaching our peers. Consequently, our insight and knowledge are restricted to Europe, North America, and China.
We have observed that HCI, with whatever name it has been called during the decades, changed focus: from the psychology of programming, to usability ergonomics, to design of interactivity, to experience design and service design, and to the involvement in use and regulation of social media.
In the history of mankind 60 years is just the blink of an eye, but creating, using, and learning about, interactive systems may be as old as humanity. Hence, we will start with some glance in the distant past.

PREHISTORY
People have been building interactive information processing systems since 40 centuries. Some have been preserved, illustrating how the first users designed and build their own artifacts, and, hence, taught themselves and their peers. These artifacts were intended and used for communication, for entertaining, for keeping track of complex data, and for (calculated) decision making. In some ancient cultures the use of this type of artifacts has even been a subject of education

HCI - WHAT'S IN A NAME
Systematic attention to usability, design for usable systems, and education for use went on without labeling the concept. The label "ergonomics" seems to have been coined by Jastrzebowski [1], the label "usability" was used to advertise a freezer in 1936 [2]. The 1982 conference labeled "Human Factors in Computing Systems" lead to the foundation of SIGCHI [3]. An early use of the label "human-computer interaction may be found in [4], "Cognitive Engineering" was the label followed by "cognitive ergonomics" in [5]. The concept of HCI kept its timeliness for a long period, but "experience design" now seems to be preferred in education [6].

A REMARKABLE YEAR
1982 is a remarkable year in the history of HCI. The first North-American HCI conference was organized In Gaithersburg, Maryland, US in 1982, by Bill Curtis and Ben Shneiderman, drawing close to 1000 attendees (leading to the foundation of ACM SIGCHI and to the CHI conference series), and at the same time the first European conference was organized in Amsterdam, by Thomas Green, Elly Lammers, and Gerrit van der Veer (leading to the foundation of EACE and to the ECCE conference series). The INTERACT conference series followed soon, originally as a European effort but since 1990 as an IFIP conference [7]. These conference series all considered HCI education as one of their basic domains and published research and case studies, and all supported the participation of students from the start.

In the next sections I will sketch the "early" development in different parts of the world where I have been involved (North America, Europe, China), when education in computing and in HCI was still a "local" effort and where communications, teaching, and conferences were mostly in the local languages, which had often the effect of isolation in focus and insight, and of restricted awareness of global development.

NORTH AMERICA
In North America the use of computers for non-mathematical use like entertainment started early. An interesting example is the Illiac Suite for String Quartet [8], a composition from 1957 where Hiller and Isaacson spend considerable effort in creating a random number generator for the Illiac electronic computer with the same goal that

Mozart [9] reached in 1792 by using dice rolls: to provide a system that randomly chooses from pre-set choices to build a musical score in a style specified by the human composer.

In 1970 Engelbart filed a patent on the first mouse, a wooden box with two wheels that served as an indicator of screen positions [10]. His approach may be considered an early example of what outside of may be considered a typical practice-oriented development [11]. The theory, in many cases, was mainly derived from the success and usability of the artifact.

After the foundation of SIGCHI as a Special Interest Group of ACM, the volunteer leadership of SIGCHI decided to develop a framework for HCI education. From 1988 a working group started to build curriculum guidelines resulting in the publication of ACM SIGCHI Curricula for Human-Computer Interaction [12]. The guidelines have been revised, and then they became referred to in several IEEE-ACM Computing education guidelines. SIGCHI officially participated in the development of these guidelines, and SIGCHI continues to have a Community on Education.

In 1993 the first CHI conference was outside North America. Amsterdam was the first location, followed in 2000 by the Hague (both in the Netherlands). In that period SIGCHI became a real international organization, with members (and volunteer leaders) from many countries. The conferences increasingly travel around the globe, educational support is a spearhead for developing new Local Chapters, and the Gary Marsden Student Development Fund has been established to support students from developing countries to attend HCI-related conferences, including conferences that are not organized or sponsored by SIGCHI.

EUROPE

HCI developments in Europe originally were rather different from North-American efforts. Theory (from different disciplines like Cognitive Psychology, Informatics, or Communication Science) lead to models that provided a framework for architectures and design approaches. But Europe, to start with, seemed rather diverse in actual viewpoints. In due time, however, the European authorities joined forces and founded research programs (COST, ESPRIT, Networks of Excellence, etc.) that allowed researchers and industry from multiple European countries to collaborate, where HCI and education of HCI ware core, resulting in a growing mutual understanding, collaboration, and enrichment.

The EU also founded international cooperation in Computing education in the Tempus project, of which HCI was a recognized part from the start. In this way, Dutch educators were sponsored to developed HCI education in several Romanian Universities [13].

The next sections provide a sample of the diversity of early European developments.

UK

HCI related developments in the UK started early with a focus on usability and a view on ergonomics of computer use. In 1970 Brian Shackel founded the research institute HUSAT (Human Science and Advanced Technology) which resulted in Ergonomics, and HCI, being an established academic discipline [14].

The HCI group of the British Computer Society (currently labeled "Interaction") was founded in 1984. The annual conference still attracts a broadly multidisciplinary mix of attendees from many (mostly European) countries to collaborate on "analysis, design, implementation and evaluation of technologies for human use", and one of their official commitment is to promote education of HCI.

The Psychology of Programming Interest Group (PPIG) was established in 1987 to bring together people from diverse communities to explore common interests in the psychological aspects of programming and in the computational aspects of psychology [15]. Remarkably, HCI researchers in the UK gradually moved from cognitive psychology departments to computing departments, and the HCI education moved with them.

German speaking Europe

Interesting in this part of Europe is the early connection between Software engineering and Psychology. The Austrian Computer Society organized annual conferences with labels like "Informatik und Psychologie" since 1981, the German Computer Society featured annual meetings of the Department Interactive Systems published with labels like "Notizen zu Interaktiven Systemen", or "Software Ergonomie" from 1983. The series still goes on as "Mensch und Computer" [16]. Apart from that, there was inter-university collaboration, bridging east and West Germany even in the age of the Berlin wall, in the MACINTER framework, with (mainly Psychology) scholars like Norbert Streitz and Friedhart Klix [17].

A strong focus in this area is on theory for the architecture of user interfaces where the dialogue between partners (human and machine) is the basic concept, resulting in user interface design tools [18] and user interface management systems [19].

The Netherlands

In my home country HCI started in the 60s, though it represented originally mainly an educational point of view: computing could be applied to support learning [20]. We used programming languages to specify cognitive psychological, as well as sociological, models to build computer simulations to predict and support human and inter-human processes, and we developed special programming languages to allow secondary school pupils to program and interact with computers [21, 22]. And in the 70s we connected schools (and pupils) by dial-in telephone lines to the single available computer in Amsterdam.

In the early 80s the Dutch government invited me and my team to educate all Dutch teacher trainers in teaching their

students (the future teachers) in computer use and teaching computer use – an effort that took us several years and aimed at country–wide computer literacy education in primary and secondary schools. Obviously, this was focused on general use and on societal aspects, not on programming [23].

HCI academic education in the Netherlands recently will be found with labels like "human-media interaction", "multimedia and culture", or "user-system interaction".

French HCI

HCI in France was (and still is) often an integrated effort of academia and industry: like aviation industry, and process control. In the early eighties, Guy Boy [24] created and led the Cognitive Ergonomics Group at the French national aerospace research center.

In the same period, Hoc and his team focused on cognitive science approaches to process control [25]. A real breakthrough in Europe was the publication in English of Sebillotte's task analysis approach (4 years after the French version!) [26].

On the other hand, in close cooperation with the British PPIP group, the psychology of programming was a major domain of early French HCI research [27].

Scandinavian approach

In the Scandinavian part of Europe, early developments showed computer scientists and psychologists collaborating, or even moving to the other discipline, like the Danish founder of the journal Cognition, Technology & Work, Erik Hollnagel [28] who early on focused on ergonomics and safety issues of interactive systems, a focus he shared with Jens Rasmussen [29] who developed the skill rule knowledge framework, or Risk Management Framework. In parallel to this type of developments, a very different view emerged (often labeled "the Scandinavian Approach"):

Trade unions in Norway, and subsequently in Denmark and Sweden, triggered by university researchers like Pelle Ehn and Morton Kyng [30] managed to work with researchers to develop a general design approach ("participatory design") where strong user-involvement during the design process as well as continuous training were key characteristics.

The Scandinavian approach often related to a specific method for analysis and design, as well as to a focus on collaboration rather than on individual users. Activity Theory (originally mainly applied in Scandinavia and the UK) provides a qualitative analytic approach towards design and implementation [31]. Originally developed from Soviet psychologists like Vygotsky and Leont'ev, the Scandinavian derivative focuses on practice and the context as well as the culture of use, and ethnography is a major method to acquire understanding.

Italy

In Italy HCI has been developed from several different strands: Faconti and Paternò have been instrumental in developing approaches towards modeling: (a) of reasoning as well as interaction specifications based on the framework of the AMODEUS project [32] and (b) of modeling task domains [33].

Bagnaro, a philosopher by education, started in 1986 with a dual professorship in Cognitive Psychology and Human-Computer Interaction, originally in Siena, later in Padua, Milano, and Alghero, where he gradually moved towards interaction design. He collaborates with numerous industries, as well as with scholars like Parlangeli, Rizzo, Marchigiani, Marti, and Mariani [34, 35].

Systematic HCI education in Italy could, apart from faculties of computing, be found in a variety of academic environments, like Communication Science at the University of Siena, or Architecture and design in the University of Sassari. (Service design).

Spain

Different developments in Spain originally were rather isolated from each other. In Granada, Andalusia, there was an early development in the cognitive psychology group that developed, among other directions, towards cognitive ergonomic approaches based on understanding of mental models of the users [36].

In Lleida (Catalonia), quite independently, Lóres Vidal founded GRIHO, a research lab for human computer interaction focusing on usability, which gradually moved focus to design for cultural heritage [37].

In the Bask town of San Sebastian, the computer science faculty originally specialized on operating systems, but Abascal gradually moved focus to ICT users with special needs [38].

Remarkably, only through participation in international projects and events these different Spanish groups found each other and in 1999 created AIPO [39] which later lead to collaboration with Portuguese as well as Latin American groups.

Poland

Polish HCI has been systematically present since the early 90s, but it has mainly been the effort of a small group, chaired by Marcin Sikorski, who founded, and still leads, the Ergonomics department in the faculty of Management and Ergonomics of the University of Gdansk. The group collaborates with industry [40], as well as developed a steady international relation through the Polish-Japanese Academy of Information Technology.

China

Chinese HCI seems to be developed relatively recent. Usability was first introduced by foreign industries, which led to the development of a local branch of UPA, of ACM SIGCHI China, and of the Sino-European Usability Centre [41], all around 2004. Since then, the Computer Science faculty of the Dalian Maritime University established a MSc in Usability Engineering, chaired by Zhengjie Liu, who continues to chair the Sino-European Usability Centre.

We are responsible for teaching a series of 5 courses in this program [42,43]: Human information processing; Research methods for usability engineering and experience design; Task analysis; Service Design; and Design for cultural heritage [44]. Interestingly, classes of students from the Luxun Academy of Fine Arts also follow parts of this education, in relation to their interactive visual art and their multimedia and animation education. Peking University, the first modern Chinese university and one of the Chinese top universities, provides summer courses on Human and societal aspects of Interaction design, intended for their postgraduate students.

THE DOMAIN MOVES

Gradually, national characteristics merge, and differences disappear. English as a second language became the lingua franca for HCI research as well as for academic education, and in large parts of the world, at least in North America, Europe, India, and China, the ACM curriculum guidelines are considered by educational authorities as examples, if not as standard.

As new application domains of computing emerge, and the related computer literacy reaches more users, the nature of the interaction changes, and, both, the design and the education for use as well as for design changes dramatically. SIGCHI is aware of this and continues to contribute to a "living curriculum" [45].

Service design, where not an artifact is the subject but a service (medical treatment, education, transportation, safety, etc.) is a major new focus of HCI [46]. We were invited to teach the first academic course ever on this topic in Italy and continue to develop and educate in this domain in China.

Other new flavors of HCI relate to the application of interactivity in art (both music, dance, and visual arts) and to the need for support in cultural participation and in the preservation of cultural heritage. Experience design is certainly part of the artistic and cultural applications, though the label is increasingly considered broadly for all interactive systems where people are using IT for private use.

Social media developed originally without active contributions from HCI, and new cultures of communication developed bottom-up as well as through industry seizing their opportunities. HCI is late in taking position, though "web culture" has been a topic in computing education at many places. It seems educating the users is top priority, as is the emerging effort to making governmental authorities aware of the issues and of possibilities of legal control.

ACM's continuing attention for academic education in computing includes HCI, or experience design as is not the label. CC2020 will include an indication of where experience design should be part of the learning objective in the various education domains (Information technology; Software engineering; Computer engineering; Computer science; and Information systems), each of which will have a specific subdomain that concerns attention for aspects of human use [47].

REFERENCES

[1] Wojciech Bogumił Jastrzębowski (1857) An outline of ergonomics, or the science of work based upon the truths drawn from the Science of Nature. Republished by Central Institute for Labour Protection, 2000

[2] The Palm Beach Post (1935) Frigidaire advertisement, March 8, 1936

[3] https://sigchi.org/conferences/conference-history/CHI/, retrieved June 2, 2018

[4] Card, Stuart K.; Thomas P. Moran; Allen Newell (July 1980). "The keystroke-level model for user performance time with interactive systems". Communications of the ACM. 23 (7): 396–410.

[5] http://www.eace.net/previousConferences.html, retrieved Jun2 2, 2018

[6] ACM and IEEE (2017) Information Technology Curricula 2017 IT2017 Curriculum Guidelines for Baccalaureate Degree Programs in Information Technology. https://www.acm.org/binaries/content/assets/education/curricula. recommendations /it2017.pdf

[7] www.interact2017.org/about, retrieved Jun2 2, 2018

[8] Hiller L, Isaacson L. (1959) Experimental Music: Composition with an Electronic Computer, McGraw-Hill, New York.

[9] Mozart W.A. (1782) Musikalisches Würfelspiel. Nikolaus Simrock, Berlin (KV 294d)

[10] U.S. Patent 3.541.541 X-Y Position Indicator for a Display System

[11] Carroll J.M. and Kellogg W.A. (1989) Artifact as theory-nexus: hermeneutics meets theory-based design. Proceedings of CHI 1989, ACM, New York, New York

[12] Hewett et al. (1992) ACM SIGCHI Curricula for Human-Computer Interaction. ACM, New York, New York

[13] Van der Veer G.C., Letia I.A. (1990) Computer Science Education: Challenges for the new millennium. Casa Cartii de Stiinta, Cluj, Romania

[14] Shackel B. (1980) Dialogues and language—can computer ergonomics help? Ergonomics 23(9):857-880

[15] http://www.ppig.org/, retrieved Jun2 2, 2018

[16] https://www.mensch-und-computer.de/category/allgemein/, retrieved July 3, 2018

[17] Streitz N. (1984) Cognitive Ergonomics: An Approach for the Design of User-Oriented Interactive Systems. In: F. Klix & H. Wandke (Eds.) Man-Computer Interaction Research (MACINTER-I), Proceedings of the First Network Seminar of the IUPsyS, 21 – 33. North-Holland Publishers

[18] Hoffmann H.-J. (1987) DIADES – A design tool for interactive programs with provisions to assess design decisions about human-machine interface. In: empirical foundations of information and software science IV – Empirical methods of evaluation of man-machine interfaces. Plenum Press. 163-175

[19] Pfaff G.E. (1983) User Interface Management Systems. Proceedings of the Workshop on User Interface Management Systems held in Seeheim, FRG, November 1–3, 1983

[20] Van der Veer G.C. (1970) Mathematical Learning models as tools for computer assisted instruction (Invited Paper). In: B. Scheepmaker, K.L. Zinn (eds) Proceedings IFIP-conference 'Computers and Education', part I: Invited Papers. Wolters-Noordhoff, Groningen, 67-70

[21] Ottevangers D.C., Van der Veer G.C. (1973) The Pupils Programming Language. In: Proceedings 9th Decus Europe Seminar, London, 283-286

[22] Van der Veer G.C., Van de Wolde G.J.E. (1982) Psychological aspects of problem solving with the help of computer languages. Computer Education 229-234

[23] Van der Veer G.C., Lammers E. (eds) (1985) Programmatuur naar menselijke maat - Cognitieve ergonomie van mens-computer systemin. Stichting Informatica Congressen, Amsterdam

[24] Boy, G.A. & C. Tessier (1983). MESSAGE: An Expert System for Crew Workload Assessment. Proceedings of the 2nd Symposium of Aviation Psychology, OHIO State University, USA.

[25] Hoc, J. M. (1987) Analysis of cognitive activities in process control for the design of computer aids. In: H. J. BULLINGER, & B. SHACKEL, K. KORNWACHS. Eds, Human Computer Interaction-INTERACT'87 pp. 257-262. Amsterdam: North-Holland.

[26] Sebillotte S. (1987) La planification hiérarchique comme méthode d'analyse de tâches; analyse de tâches de bureau, Rapport de Recherche N°599, INRIA Rocquencourt

[27] F. Détienne, (1990) "Empirical Study of Design in an Object-Oriented Environment", presented at the 01/1990, PPIG 1990 - 2nd Annual Workshop, 1990.

[28] Hollnagel, E. (1971) Informationspsykologi. Dansk Psykolognyt, 16, 307-308.

[29] Rasmussen J. (1986) Information processing and human-machine interaction: an approach to cognitive engineering. North-Holland.

[30] Bjerknes G., Ehn P., Kyng M. (1987) Computers and democracy-a Scandinavian challenge. Gower Publishing Ltd

[31] Nardi B. (1995) Context and Consciousness: Activity Theory and Human-Computer Interaction. MIT Press

[32] Faconti G.P. and Fornari A. (1995) Syndetic Modelling and Gestural Interaction. In Stefanidis C. (Ed.), Proc. of Workshop on User Interfaces for all, Heraklion, Crete. European Research Consortium for Informatics and Mathematics (ERCIM)

[33] Paternò F. (2003) ConcurTaskTrees: An Engineered Notation for Task Models. The Handbook of Task Analysis for Human-Computer Interaction: 483–503

[34] Parlangeli O., Marchigiani E., Bagnara S. (1997) Strumenti multimediali per la formazione: incidenza del livello di usabilità dei sistemi di apprendimento. Convegno A.I.P., Capri

[35] Rizzo A., Mariani M., Zenie A., Bagnara S. (1997) Designing the information Cooperative for Harmonizing, Coordinating, and Promoting Earth Observation Business Process. In G. Salvendy, M.J. Smith, & R.J. Koubek (Eds.), Design of Computing Systems: Cognitive Considerations. Amsterdam: Elsevier, pp. 741-74

[36] Cañas J.J., Bajo M.T., Navarro R., Padilla F., Puerta M.D.C. (1998) Representación mental y programación de ordenadores Mental representation and computer programming. Cognitiva 1 (1), 239-255

[37] Sendín M., Lorés J., Aguiló C., Balaguer A. (2001) Un modelo interactivo ubícuo aplicado al patrimonio natural y cultural del área del Montsec. IHO series 153, 22-25

[38] Arruabarrena A., Abascal J. G. (1989) Dispositivos de comunicación. In: L. Gardeazabal (Ed.): Aplicaciones del ordenador y de las nuevas tecnologías en la ayuda a personas con discapacidad. Servicio Editorial de la UPV-EHU, 103-126

[39] Abascal J. and Lorés J. (2003) HCI in Spain. In: M. Rauterberg et al. (Eds.) INTERACT'03. IOS Press, 1077-1078

[40] Sikorski M. (1997) Transferring usability engineering to software houses: some practical experiences. CHI 1997 extended Abstracts, 45-46

[41] Liu, Z. (2006). Usability Practice in China: An Update. User Experience Magazine, 5(2). http://uxpamagazine.org/usability_practice_china/ retrieved July 4, 2018

[42] Van der Veer G.C. (2013) Teaching HCI in China. ACM interactions 20(1): 82

[43] Consiglio T., van der Veer G.C. (2015) ICT support for collaborative learning – a tale of two cities. P. Isaias et al (eds) E-learning systems, environments and approaches. Springer Switzerland

[44] Consiglio T., Uras S., van der Veer G.C. (2015) Teaching Design for Living Memory. HCITOCH 2015, Human-Computer Interaction, Tourism and Cultural Heritage • Sep 20, 2015 (15 pages)

[45] Peters A., Jordan Z., Merkle L., Rocha M.M., Nocera J.A., van der Veer G.C., Dray S., Preece J., Churchill E. (2016) Teaching HCI: a living curriculum. AfriCHI'16: Proceedings of the First African Conference on Human Computer Interaction

[46] Consiglio T., van der Veer G.C. (2012) Design for free learning: a case study on supporting a service design course. August 2012 WikiSym '12: Proceedings of the Eighth Annual International Symposium on Wikis and Open Collaboration

[47] Clear A., Parrish A., van der Veer G.C., Zhang M. (2017) CC2020: A Vision on Computing Curricula. SIGCSE '17 Proceedings of the 2017 ACM SIGCSE Technical Symposium on Computer Science Education, March 08-11, 2017, Seattle, WA, USA.